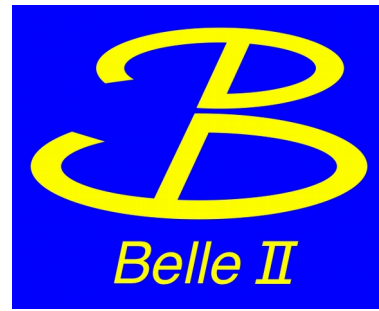




MAX-PLANCK-GESELLSCHAFT



Vertexing: status and plans

Luigi Li Gioi

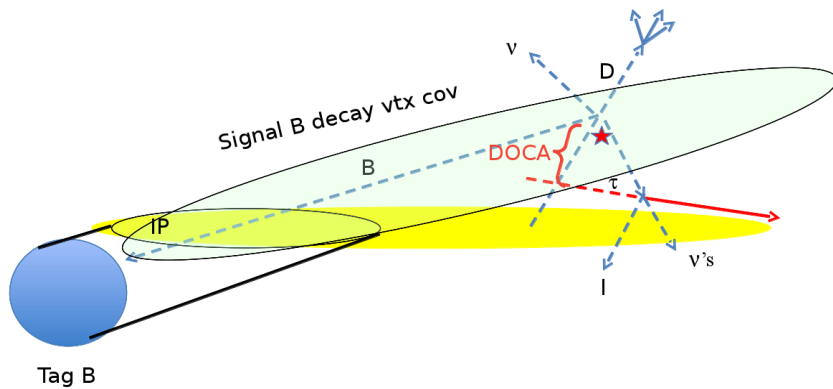
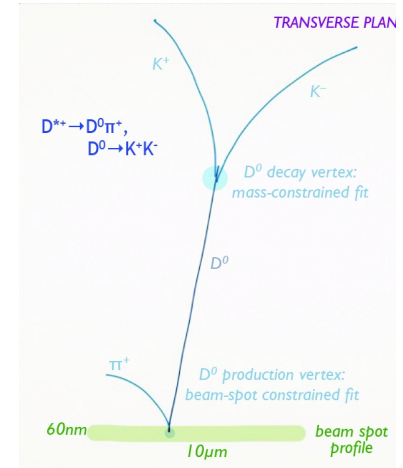
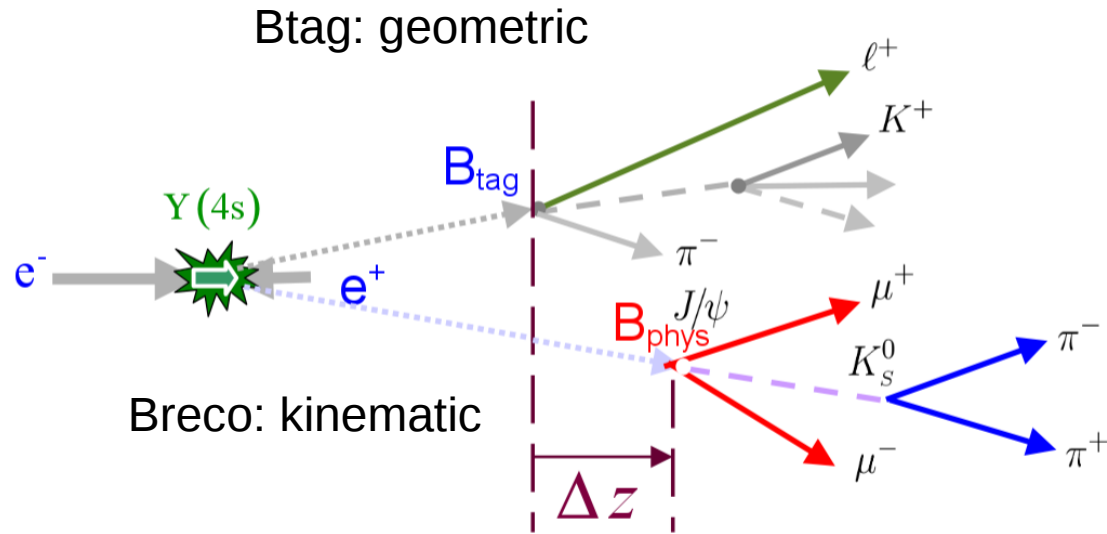
Max-Planck-Institut für Physik, München



Max-Planck-Institut für Physik
(Werner-Heisenberg-Institut)

Belle II Face to Face tracking meeting
Munich – January 11th 2016

Vertexing in Belle II



Recoil vertex: kinematic/geometric

Decay chain: kinematic

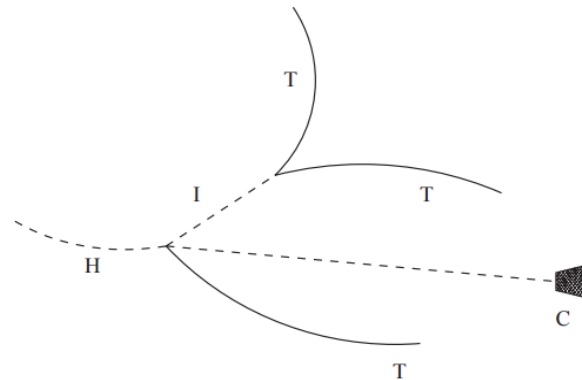
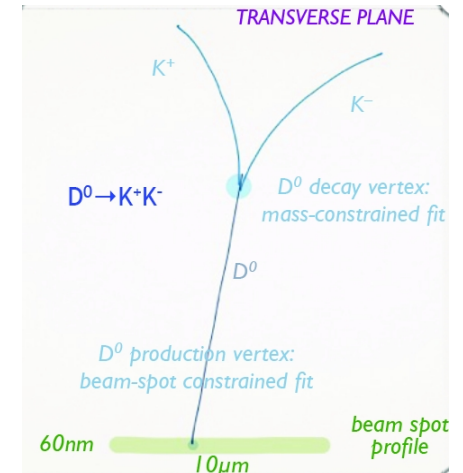


Fig. 1. Schematic picture of a decay tree with three charged particles reconstructed as track segments (T), one photon reconstructed as a calorimeter cluster (C), and two composite particles (I for 'internal' and H for 'head').



Single track: geometric

What is (not) available

Standard kinematic fit:

- BS constrained Kinematic fit
- IP tube constrained kinematic fit
- Single track geometric kinematic fit
- Production vertex of a pseudo-track BS constrained
- Check if helix parametrization is available in RAVE

Geometric fit:

- Tag Vertex: interface for using helix parametrization
- No particle interface foreseen at the moment
- Single track BS constrained geometric kinematic fit: uses particle

Decay chain fit:

- Development at the beginning

Algorithms

- Different notations that can produce confusion/misunderstanding
- Definition of few names

Standard or Global Chi2 fit: standard Chi2 Kinematic fit with Lagrange multipliers for constraints

- CPU intensive
- Big covariance matrices to invert. Very slow in case of decay chain fit
- Natural approach for global covariance matrix

(Extended) Kalman filter or progressive fit:

- Less CPU intensive
- Covariance matrix for each constraint

Adaptive Vertex Fitter:

- Geometric fit
- Weights tracks according to compatibility the entire sample
- Used in tag vertex

Tools

RAVE: stand alone package from (an old version of) the CMSSW vertex libraries

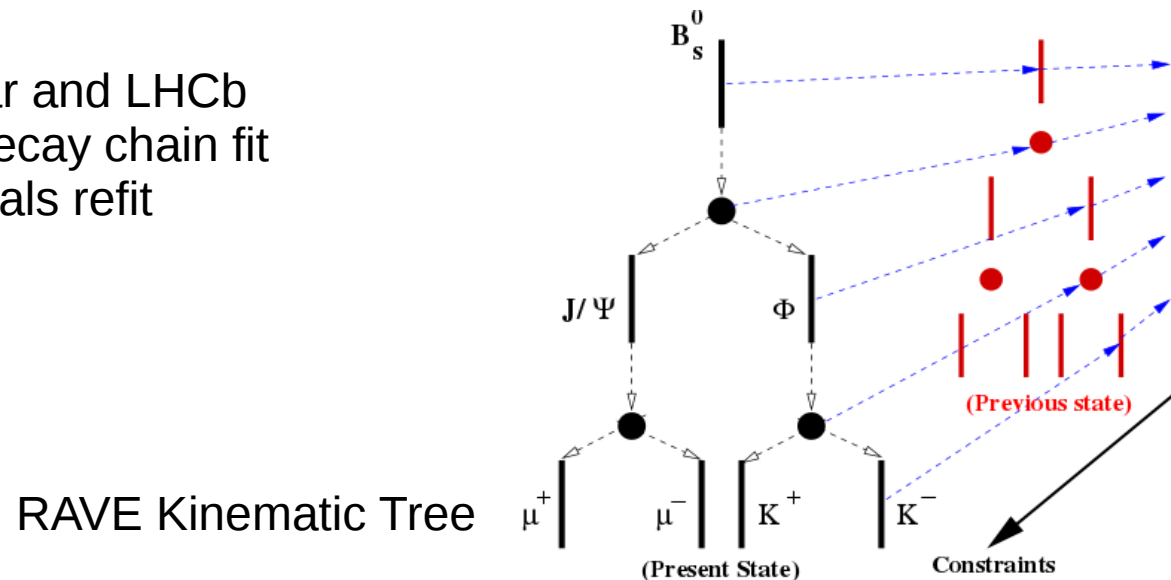
- Strong geometric fitter
- Some debugging/development needed in the Lagrange and sequential kinematic fitter
- No up \rightarrow down Decay Chain capability

Kfitter: used in Belle

- Global approach for both single and decay chain fits
- Could be useful in charm Physics

TreeFitter: Used in BaBar and LHCb

- Progressive/Kalman decay chain fit
- Useful in case of neutrals refit



Outlook

To be done/short term:

- Present version of RAVE and CMSSW RecoVertex have no decay chain capabilities
- Treefitter: how to interface to basf2 (particles objects)
- RAVE:
 - Debugging: kinematic fit API and kinematic BS constrain (y direction)
 - Review memory usage
 - Check if RecoVertex should be updated

Feasible/middle term:

- Module for building constrained kinematic trees in RAVE
 - Could allow to use track parametrization in kinematic fit
 - Belle2Tree data object needed
- Could be used by TreeFitter too
- Kfitter decay chain in basf2

Ideal/long term: depending of what is actually available in CMSSW

- TreeFitter in RAVE
 - Could use RAVE kinematic trees as interface
- Kfitter global approach in RAVE
- Only one tool
- The entire vertexing library would be independent from any basf2 change